### Machine Learning in Heliophysics Amsterdam, 16 – 20 September 2019



## Monday 16<sup>th</sup> September

8:30 - 9:30 9:30 - 10:00	Registration and coffee Introductory Remarks
Session 1 – Chairs	: Monica Bobra, Pete Riley
10:00 - 10:40	<b>Barbara Thompson</b> (NASA GSFC, USA) Frontiers in Data Science and Machine Learning in Heliophysics
10:40 - 11:10	Coffee Break
11:10 – 11:30	<b>Laura Hayes</b> (NASA GSFC, USA) Predicting Global Navigation Satellite System (GNSS) Signal Disruptions Using Machine Learning Techniques
11:30 – 11:50	<b>Will Barnes</b> (LMSAL, USA) Seeing the Trees through a Random Forest: Details of Active Region Heating Revealed through Forward Modeling and Classification
11:50 – 12:10	<b>John Armstrong</b> (University of Glasgow, UK) RADYNVERSION: Learning to invert a solar flare atmosphere using invertible neural networks
12:10 – 12:30	<b>Varad Deshmukh</b> (University of Colorado at Boulder, USA) Leveraging Topological Data Analysis and Deep Learning for Solar Flare Prediction
12:30 - 14:30	Lunch

#### Session 2 – Chairs: Enrico Camporeale, Farzad Kamalabadi

14:30 – 15:10	<b>George Karniadakis</b> (Brown University, USA) Physics-informed neural networks
15:10 – 15:30	<b>Ryan McGranaghan</b> (ASTRA, USA) What is the social engineering challenge of data science for Heliophysics and how do we solve it?
15:30 – 15:50	Hazel Bain (CIRES CU Boulder & NOAA Space Weather Prediction Center) Solar Energetic Particle Forecasting Using Machine Learning Classification Techniques
15:50 – 16:30	Coffee Break

16:30 - 16:50	<b>Tarik Salman</b> (University of New Hampshire, USA) Forecasting Periods of Strong Southward Magnetic Field Following Interplanetary Shocks
16:50 – 17:10	<b>Ruizhu Chen</b> (Stanford University, USA) Estimating the Sun's Far-Side Magnetic Flux from EUV flux by deep learning
17:10 – 17:30	<b>Paul Wright</b> (Stanford University, USA) DeepEM: A Deep Learning Approach for DEM Inversion
18:30 - 20:00	Reception

## Tuesday 17<sup>th</sup> September

- 8:00 8:30 Coffee
- 8:30 9:30 **John Armstrong** (University of Glasgow, UK) *Tutorial on ML, part 1*

(online on https://github.com/rhero12/teaching/tree/master/Amsterdam2019)

- pre-processing a ML dataset using libraries like Numpy and Pandas;
- how to use classical ML methods with scikit-learn and deep methods with PyTorch ;
- *testing and validation.*

#### Session 3 – Chairs: Stefan Lotz, Sophie Murray

9:30 - 10:10	<b>Robert McPherron</b> (University of California, Los Angeles, USA) <i>Early Studies in Space Physics Using Machine Learning</i>
10:10 - 10:30	<b>Monica Bobra</b> (Stanford University, USA) An Overview of Solar Flare Prediction Using Machine Learning Techniques
10:30 - 11:10	Coffee Break
11:10 – 11:50	<b>Naoto Nishizuka</b> (NICT, Japan) Solar Flares and Eruptions Predicted by Deep Neural Networks: Deep Flare Net (DeFN)
11:50 – 12:10	<b>Michael Kirk</b> (NASA GSFC, USA) Using Deep Learning to Segment Features in Solar EUV Images
12:10 – 12:30	<b>Dattaraj Dhuri</b> (TATA, Mumbai, India) Machine learning reveals systematic accumulation of electric current in lead-up to solar flares
12:30 - 14:30	Lunch

14:30 – 17:30 Poster session A (with coffee)

# Wednesday 18<sup>th</sup> September

#### Session 4 – Chairs: Simon Wing, Bala Poduval

8:00 - 8:30	Coffee
8:30 – 9:30	<b>Monica Bobra</b> (Stanford University, USA) <i>Tutorial on ML, part 2:</i>
	• resources for machine learning in heliophysics and astrophysics;
	<ul> <li>open source software for machine learning, parallel computing, and heliophysics;</li> </ul>
	• best practices for scientific reproducibility (how to publish research code and how to publish open source software).
9:30 - 10:10	<b>Cyril Furtlenher</b> (INRIA, France) A machine learning approach to solar wind speed forecasting from solar images
10:10 – 10:30	<b>Constantinos Papadimitriou</b> (National Observatory of Athens Greece) Investigating dynamical complexity in the topside ionosphere using information-theoretic measures
10:30 - 11:10	Coffee Break
11:10 – 11:30	<b>Savvas Raptis</b> (KTH, Sweden) Classification of Magnetosheath Jets using Neural Networks and High Resolution OMNI (HRO) data
11:30 – 11:50	<b>Mayur Bakrania</b> (MSSL, UK) Using Big Data Techniques to Classify Solar Wind Electron Populations
11:50 –12:10	<b>Pete Riley</b> (Predictive Science Inc., USA) A Metric-Based Assessment of New Solar Wind Forecast Models incorporating Data Assimilation
12:10 – 12:30	<b>Romain Dupuis</b> (KU Leuven, Belgium) Identifying specific features for the study of magnetic reconnection from PIC simulations using unsupervised learning at the particle scale
12:30 - 14:30	Lunch

#### Session 5 – Chairs: Giovanni Lapenta, Michael Kirk

14:30 – 15:10	<b>Peter Wintoft</b> (Swedish Institute of Space Physics, Sweden)
	Space weather - Dynamical systems modeled by neural networks

15:10 – 15:30	<ul> <li>Abigail Azari (University of Michigan, USA – Metcalf award speaker)</li> <li>Multivariate Supervised Classification for Instabilities at Saturn:</li> <li>A Comparison of Methods for Automated Event Detection in Magnetospheres</li> </ul>
15:30 – 15:50	<b>Vincent Génot</b> (IRAP, France) Automated detection and dynamics of Martian plasma boundaries
15:50 – 16:30	Coffee
16:30 – 17:10	<b>Joe Borovsky</b> (Space Science Institute, USA) <i>Vector-Vector Correlations: The Solar Wind and the Magnetosphere</i>
17:10 – 17:30	<b>Lika Guhathakurta</b> (NASA, USA) NASA Frontier Development Lab: Applied AI for Science & Exploration

# Thursday 19<sup>th</sup> September

### Session 6 – Chairs: Hazel Bain, Jacob Bortnik

8:00 - 8:30	Coffee
8:30 – 9:10	<b>Dan Baker</b> (University of Colorado Boulder, USA) Heliophysics Data Science: Past Experience and Future Prospects
9:10 – 9:30	<b>Rakesh Sarma</b> (CWI, Netherlands) On improvement of Phase Space Density estimation with Bayesian Inference and Deep Learning
9:30 – 9:50	<b>Timo Laitinen</b> (University of Lancashire, UK) Bayesian analysis of solar wind turbulence for solar energetic particle transport
9:50 – 10:10	<b>Irina Zhelavskaya</b> (GFZ Potsdam, Germany) A combined neural network- and physics-based approach for modeling the plasmasphere dynamics during extreme geomagnetic storms
10:10 – 10:30	<b>Gonzalo Cucho-Padin</b> (University of Illinois, USA) Dynamic Tomographic Estimation of Global Exospheric Hydrogen Density and its Response to Geomagnetic Storms
10:30 - 11:10	Coffee Break
11:10 – 11:50	<b>Adam Lesnikowski</b> (Nvidia, USA) Data-Driven Datasets: Deep Active Learning and Beyond
11:50 – 12:10	<b>Sigiava Aminalragia-Giamini</b> (SPARC, Greece) High quality particle fluxes from space radiation monitor data using Artificial Intelligence and Machine Learning methods

12:10 - 12:30	<b>Carlos Jose Diaz Baso</b> (Institute for Solar Physics, Sweden, Stockholm) Solar image denoising with convolutional neural networks
12:30 - 14:30	Lunch
14:30 - 17:30	Poster session B (with coffee)
18:30 – 19:30	Boat trip
19:30	Social Dinner

# Friday 20<sup>th</sup> September

Session 7 – Chairs:	Mark Cheung, Enrico Camporeale
8:00 - 8:30	Coffee
8:30 – 9:00	Early career awards
9:00 - 9:20	<b>Adeline Paiement</b> (Université de Toulon, France) <i>Detection and parameter estimation for type II solar radio bursts</i>
9:20 – 9:40	<b>Eoin Carley</b> (Trinity College Dublin, Ireland) Using supervised machine learning to automatically detect type II and III solar radio bursts
9:40 - 10:00	<b>Enrico Camporeale</b> (University of Colorado Boulder, USA) On the generation of probabilistic forecasts from deterministic models
10:00 - 10:20	<b>Egor Illarionov</b> (Moscow State University, Russia) Segmentation of solar disk images with a convolutional neural network
10:20 - 10:40	<b>Derek Lamb</b> (Southwest Research Institute, Boulder, USA) Comparing Statistical and Neural Network Approaches to Flux Emergence Identification
10:40 - 11:20	Coffee
11:20 - 11:40	<b>Jorge Amaya</b> (KU Leuven, Belgium) Automatic unsupervised classification of the solar wind using Self-Organizing Maps
11:40 – 12:00	<b>Gregal Vissers</b> (Stockholm University, Sweden) Classification and tracking of ultraviolet reconnection bursts as tracers of lower-atmosphere field evolution
12:00 - 12:20	<b>Meetu Verma</b> (AIP Potsdam, Germany) Classification of High-resolution Solar Hα Spectra using t-SNE

13:20 Farewell lunch (bag lunch available)

# List of posters

#### Important: the max size allowed for posters is A0-portrait (841 x 1189 mm or 33.1 x 46.8 in)

#### Poster session A

1) Kirsten Arnason	Relationship between Precipitation of High Energy Electrons and Solar Wind and Ring Current
2) R. L. Bailey	PREDSTORM and SOLARWIND2GIC: Forecasting of space weather effects and
	geomagnetically induced currents with Python
3) Teo Bloch	Solar Wind Classification using Unsupervised Machine Learning
4) Pedro Brea	Using Machine Learning Techniques to Forecast Solar Energetic Particles
5) Wendy Carande	Challenges of Using Machine Learning for Solar Flare Prediction and Prospective Solutions
6) Mandar Chandorkar	Predicting Time Lagged Effects of Solar Activity: A Deep Learning Approach
7) Silvia Dalla	SPARX: a propagation based modelling system for Solar Energetic Particle Space Weather forecasting
8) Grigol Dididze	Comparative analysis of solar radio bursts before and during CME propagation
9) Alina Donea	Training data sets for machine learning algorithms to detect magnetic polarities of far side solar regions
10) Frederic Effenberger	Deep Learning with Solar Images
11) Shea Hess Webber	Using Deep-Learning to Map the Solar Far-Side Magnetic Flux from Helioseismic Measurements
12) Taras Yakobchuk	Scattering linear polarization of late-type active stars
13) Jack Ireland	Detecting and tracking large scale EUV waves in the solar atmosphere
14) Robert Jarolim	Image Quality Assessment and Reconstruction of Solar H-alpha Images with Deep Learning
15) Seong-gyeong Jeon	Generation of future solar magnetograms from previous SDO/HMI data using conditional Generative Adversarial Networks (cGAN)
16) Anjali Kaithakkal	Identification and tracking of small-scale magnetic features on the solar photosphere
17) Maria Kazachenko	A Database of Flare Ribbon Properties From Solar Dynamics Observatory
18) Yasuhiro Nariyuki	Stochastic modeling of charged particle scattering by transverse electromagnetic waves in space plasmas
19) Christoph Kuckein	Automatic identification of solar phenomena using high-resolution GREGOR images
20) Chia-Hsien Lin	Helioseismic investigation of the solar-cycle variation of the meridional flows in the solar convection zone
21) Karen Mever	Determining Properties of Solar Active Regions using Machine Learning
22) Christian Moestl	PREDSTORM - a new L1 solar wind and magnetic storm prediction system
23) Daniel Müller	3D Visualization of Solar Data: Preparing for Solar Orbiter and Parker Solar Probe
24) Kilev Yeakel	Automatic Determination of In-Situ Magnetospheric Regions Around Saturn
25) Adeline Paiement	Solar RCNN: detection and segmentation of solar active regions from 3-dimensional multispectral images
26) Andong Hu	Using Gaussian Process-aided Deep Neural Network Method for Ionospheric NmF2 Modelling Based on GNSS Radio Occultation Measurements
27) Carl Shneider	A Deep Learning Approach to Forecast Tomorrow's Solar Wind Parameters
28) Jih-Hong Shue	Automatic identification on elements of whistler-mode chorus waves
29) Suvadip Sinha	Tracking the solar filaments in their eruptive phase and finding the temporal connection with flare-CME events
30) Vishal Upendran	Solar wind prediction using Deep learning
31) Harry Warren	Event Detection in Observations and Simulations of Solar Active Regions

32) Simon Wing	Information theoretic approach to discovering causalities in the solar cycle
33) Paul Wright	A Machine Learning Dataset From the NASA Solar Dynamics Observatory
34) Yongliang Zhang	Solar EUV proxy using multi-frequency solar radio flux and thermospheric FUV dayglow
35) Ute V. Amerstorfer	Forecasting of magnetic flux rope fields at the Sun-Earth L1 point
36) Bernard Benson	Determining the parameter for the linear force-free magnetic field model with multi- dipolar configurations using deep neural networks
37) Dattaraj Dhuri	Deep learning applied to detect pre-emergence photospheric magnetic field patterns
38) Gulsun Dumbadze	Classification of active regions by magnetic flux and long-period oscillatory properties
39) Chia-Hsien Lin	Examining the EUV intensity in the open magnetic field regions associated with coronal holes
40) Andy Smith	The Rate of Change of the Surface Magnetic Field in the UK: Sources and Forecasting
41) Maher A Dayeh	Forecasting the spectral indices of Energetic Storm Particle events
42) Raluca Ilie	Forecasting the magnetospheric plasma conditions using Machine Learning Techniques and Cluster RAPID data
43) Magnus Wik	Forecasting the AU and AL indices using recurrent networks
44) Benoit Tremblay	Emulating Numerical Simulations of the Sun to Infer Synthetic Plasma Motions at the Photosphere and in the Upper Convection Zone
45) Ruggero Vasile	Understanding geomagnetic activity through supervised learning
46) Matthias Waidele	Helioseismology of Sunspots: Surface effects of simple fluxtubes
47) Andreas J. Weiss	Inferring initial conditions of coronal mass ejections using a fast data generative model and approximate bayesian computation
48) George Wilkie	Neural-network informed parameterization of diffusion in the radiation belts
49) Jake R. Wilson	SITH: A machine-learning-based comparison of the DEMON and JEDI coronal eruptive dimming catalogs

## Poster session B

1) Tanja Amerstorfer	Automated CME tracking within heliospheric images
2) Matthew R. Argall	Automated magnetopause detection to facilitate diffusion region studies with MMS
3) Simon Wing	Untangling the solar wind drivers of the radiation belt electrons
4) Vincent Barra	Image-to-image translation model to generate magnetogram out of EUV images
5) Sabrina Bechet	Data homogenization for a network of ground-based synoptic imaging telescopes
6) Monica Bobra	HelioML: Machine Learning, Statistics, and Data Mining for Heliophysics
7) Jacob Bortnik	Neural network based reconstruction of inner magnetospheric density, waves, and energetic electron fluxes
8) Luca Bucciantini	Machine learning on the ROSETTA/RPC-MIP and CLUSTER/WHISPER spectra.
	Preparation of BepiColombo and JUICE
9) Suhaila Binti Buhari	Spatial Relation Between Large Scale Wave Structures (LSWSs) Prior to the Onset of
	Successive Equatorial Plasma Bubbles (EPBs)
10) Khaled AliElden	Predicting the Stream Interaction Regions at Earth: A Machine Learning Approach
11) Angelica M. Castillo	Data assimilation of LEO satellite data into VERB-3D simulations
12) Alemayehu Cherkos	Effect of viscosity on propagation of MHD waves in astrophysical plasma
13) Eurico Covas	Spatial-temporal forecast of the sunspot butterfly diagram
14) Daniel da Silva	Case Study of Applying Neural Network to Remove Non-Linear Instrument Noise
15) Curt A de Koning	Noise Analysis and Noise Reduction of Differenced STEREO/COR2 Images
16) Andrea Diercke	Automatic extraction of Polar Crown Filaments using machine learning techniques
17) Laurel Farris	Enhanced chromospheric 3-minute oscillatory power associated with the 2011-February- 15 X2.2 flare
18) Bea Gallardo-Lacourt	Automatic Polar Cap Boundary Identification Using Redline Imaging Data
19) Philippe Garnier	Automatic detection of magnetopause reconnection diffusion regions
20) Forrest Gasdia	VLF Mapping of the D-region Ionosphere Using an LETKF
21) Andrei Gorobets	Small-scale magnetism of the quite Sun: quantifying temporal dynamics.
22) L. F. Guedes dos Santos	Using Image Recognition and Supervised Learning to Identify Flux Ropes

23) Verena Heidrich-Meisner	How similar are time series of elemental abundances of different low first ionization potential elements?
24) Jürgen Hinterreiter	Statistical study on CME arrival prediction using ELEvoHIensemble modeling
25) Robert Jarolim	Multi-Channel Coronal Hole Detection with a Convolutional Neural Network
26) Kimoon Kim	Generation of COMS VIS images from COMS IR images at night by Deep Learning
27) Michael Kirk	Extracting Science from the AIA Trash Pile with Machine Learning
28) Othniel Konan	Investigation of Modern Machine Learning Techniques to Detect and Characterize
,	Whistler Waves
29) Alexandros Koukras	Flare Prediction using Deep Learning with multiple wavelength SDO data
30) Elena Kronberg	Prediction of soft protons in the near-Earth space using machine learning
31) Brecht Laperre	Pitfalls in the prediction of the Dst index using ANN
32) Daye Lim	Prediction of Major Flares Based on Short, Mid, and Long-term Active Region Properties
33) Stefan Lotz	A neural network based method for input parameter selection
34) Simon Mackovjak	Comparison of airglow intensities prediction by ML models and physical model
35) Shane Maloney	X-ray Image Deconvolution using Neural Networks
36) Sophie Mathieu	Modelling of sunspot time series for improved quality control
37) Ryan McGranaghan	New capabilities in geospace prediction: Machine learning advances for the complex, multiscale ionosphere
38) Momchil Molnar	Recovering spectral line profiles multiplexed with Fabry-Perot etalon with Machine
	Learning approach
39) Sophie Murray	Forecasting Solar Wind Velocities from Coronal Hole Properties using Machine Learning
	Techniques
40) Andrés Muñoz-Jaramillo	Homogenization of 50 Years of Magnetograms Using Convolutional Neural Networks
41) Suvadip Sinha	Detecting the source region of apparent stealth CMEs using Multiscale Gaussian
	Normalisation (MGN) technique.
42) Ambelu Tebabal	Feedforward neural network based ionospheric model for the East African region
43) Mohamed Nedal	Predicting the transit time of Halo-Coronal Mass Ejections using Machine Learning
	Techniques
44) Barbara Thompson	AI "Fails": How unsuccessful experiments help us learn faster
45) Shaktivel Pillai	Automated Detection and Tracking of Active Regions(Machine Learning over Traditional
46) Khaled AliElden	Predicting the Stream Interaction Regions at Earth: A Machine Learning Approach
47) Sumiaya Rahman	SDO/HMI image Super Resolution using Deep Learning Method
48) Yeimy Rivera	Investigating a prominence eruption using a non equilibrium ionization code constrained
	to heliospheric measurements of composition
49) Han-Wen Shen	Geomagnetic effects in precipitating particles of the high-latitude ionosphere
50) Jih-Hong Shue	An Application of Random Forest Method in Retrieving Importance of Parameters that
	Quantify Characteristics of Chorus Elements
51) Lekshmi B	Predicting Solar Active Region Emergence Using Machine Learning
52) Bala Poduval	Determination of a Solar Wind Index for Space Weather Prediction using Machine
	Learning

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